



ABSTRACT AND BIOGRAPHY

Lessons in Systems Engineering – The SSME Weight Growth History

Requirements, Technology Capability and Design Must Balance Early in Development Cycle. Pump-fed liquid engines are one of the most complex and challenging subsystems on the entire launch vehicle and present many systems engineering challenges. Pump-fed liquid engine design requires many of the same design functions and analysis disciplines that the vehicle design uses, but liquid rocket engines have much higher power densities than more conventional transportation system engines. This creates extreme environments and stretches the limits of design and analysis capabilities. There is a strong tendency to view systems engineering as the processes that bring the designed parts together (integration) rather than creating "Integrated Designs." This is based on the assumption that you can break the system apart assuming linearity and handle everything by defining pertinent requirements, defining and managing interfaces, design data flow, and then designing the parts. When the system is put back together it will perform ok. This is a false assumption because there are many nonlinear interactions in a complex "system" causing the parts to perform different together than apart. It also assumes design development is serial and not iterative in nature. The SSME weight growth is a good example of how systems engineering can go wrong with this assumption rather than creating a balanced integrated systems design.

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Mr. Ryan currently serves on the technical staff to the MSFC Chief Engineer as the Senior technical expert in the area of liquid rocket engine design.

He has over (27) years at MSFC in advanced propulsion design to include multiple positions in Liquid Propulsion Systems leading many studies and design activities both at the propulsion and vehicle systems level. His experience covers early SSME turbomachinery development, National Launch System turbomachinery design, the first Space Exploration Initiative propulsion trade studies, the X-33 propulsion design, and the Reusable Launch Vehicle Program propulsion technology maturation.

Prior to this position, Mr. Ryan served in numerous capacities: propulsion team lead in the Exploration Propulsion Development Office, project manager Propulsion Technology and Integration Project (PTIP), lead systems engineer PTIP, and Deputy Project Manager TR107 Technology Prototype Engine Development Project.

Mr. Ryan also served in a detail to HQ in the Office of Space Flight's Chief Engineer's Office in 1991-92. He holds a BS in Mechanical Engineering from the University of Tennessee. He has numerous awards including the MSFC Center Director's Commendation Certificate.



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